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OBSERVATIONS ON THE NESTING OF *POMPILUS*
(*AMMOSPHEX*) *MICHIGANENSIS* (DREISBACH)
(HYMENOPTERA; POMPILIDAE)

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Studies on the Nearctic *Pompilus* have lagged far behind those on the European members of this spider wasp genus. Especially is this the case in the subgenus *Ammosphex* Wilcke where only a single, detailed observation, that by Powell (1957) on the western *occidentalis* (Dreisbach), is available. The only other ethological data which have been published for Nearctic *Ammosphex* take the form of scattered host records (Evans, 1951; Evans, 1959; Evans and Yoshimoto, 1962; Wasbauer and Powell, 1962). It is felt, therefore, that the following notes on *Pompilus* (*Ammosphex*) *michiganensis* (Dreisbach), the first observations on this rarely collected species, will shed light on the behavior of this little known group of wasps.

On 25 May 1963, at about 2:55 PM in an open area of soil occupying a portion of a field directly behind a sand pit in Groton, New York, a female *michiganensis* was seen apparently searching for an area in which to dig her nest. Walking forward rather slowly, tapping the soil with her distal antennal segments and flicking her wings incessantly, she made many small circles on the soil surface. Finally, selecting an area underneath two overhanging stems, the wasp began excavating, loosening the soil with her mandibles. She flung the earth backwards by means of her forelegs, keeping her wings folded nearly flat over the dorsum of her abdomen. We could not ascertain exactly how the forelegs were used but the related Palearctic *Pompilus trivialis* Dahlbom has been photographed (Olberg, 1959) using its front legs alternately. At times, as she dug deeper into the earth, the female we observed main-



tained a position nearly vertical while loosening the soil. Disappearing from sight entirely, the wasp continued pushing damp soil into the entrance from below. She removed the accumulation by backing out of her excavation at intervals which varied from about 15 seconds to 1 minute, kicking the soil alternately with her hind legs as well as shoving it backward with the tip of her abdomen. Rarely, she cleared the area in front of the entrance completely, throwing the earth backward with her front legs instead of kicking it with the hind legs (Fig. 1). Powell (1957) found that *occidentalis*, while digging, left her burrow only when bringing up earth from below. Periodically, *occidentalis* backed out of her burrow, "scraping the loose material from the tunnel entrance" with her front legs. Each time *P. michiganensis* cleared the sand from in front of her entrance, she proceeded back into the burrow, throwing sand backwards with her front legs.

Less than 25 minutes from when she began digging, the wasp appeared head first in her entrance, twisting her head to the left and right while cleaning her mandibles and antennae with her forelegs. Having cleaned herself in the entrance for about 3-5 seconds, she came completely out of the burrow onto the soil which had accumulated from digging where she paused motionless for about 20 seconds. She then turned and, leaving her entrance open, made a low, rapid flight of about 1 meter to her prey which she had placed in the grass. Adlerz (1903) found that females of both *Pompilus wesmaeli* Thomson and *P. trivialis* frequently place their prey on the top of vegetation before excavating their nests.

Pulling her prey from the vegetation, *P. michiganensis* began dragging it across the ground, grasping it in her mandibles by the bases of the prey's second or third pair of coxae. Holding the spider so that its body was nearly perpendicular to her own, the wasp walked rapidly backward through vegetation and over stones and other debris, proceeding nearly straight to her nest. Evans (1959) captured a *Pompilus* (Am-

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FIGS. 1-2. *Pompilus michiganensis* (Dreisbach). 1, Female clearing soil from entrance, using forelegs. 2, Placement of spider inside wasp's entrance before it is pulled into burrow.



mosphex) *angularis* (Banks) carrying her prey backward, "grasping the spider near the petiole in such a way that its body was perpendicular to that of the wasp." *P. michiganensis* dropped the spider, leaving it dorsum up 25–30 cm from the nest entrance, reentered the burrow, throwing soil backward, and reappeared head first in the opening about 10 seconds later. Powell (1957) noted similarly that during prey transport, *occidentalis* left her spider and inspected her nest before bringing the prey in. Leaving her burrow again, *michiganensis* proceeded on foot to her prey and grasping it in the same manner as before, pulled it directly to the entrance. Here, she turned around before entering and released the spider momentarily. The spider was now in a position with its abdomen inside the entrance and its cephalothorax directed away from the burrow (Fig. 2). Walking directly over the top of her prey, the wasp entered the burrow head forward, turned around inside the nest, and grasping the spider in her mandibles by its spinnerets, pulled it inside. As the spider disappeared slowly from sight, its legs were the last structures seen in the opening. Olberg (1959) noted that *trivialis* always transports her prey backwards, places it in the entrance, and then, seizing it from below by its spinnerets, drags it into the nest. Powell (1957) observed *occidentalis* backing down into her burrow "dragging the spider in."

Staying inside nearly three minutes, *michiganensis* appeared head first in her burrow, breaking down the sides and top of the tunnel with her mandibles. Hammering the resulting loose soil with the tip of the abdomen, the wasp packed it into place inside the burrow. While hammering, the wasp's antennae were held laterally and curled at the distal ends (Fig. 3). Coming out of her nest with her front legs bent medially so as to form a basket, the wasp pulled soil from in front of the entrance down into the burrow where she continued packing it into place. Powell (1957) noted *occidentalis* reappearing three minutes after ovipositing, "pulling the loose

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FIGS. 3–4. *Pompilus michiganensis* (Dreisbach). 3, Female packing soil into nest with the tip of the abdomen. 4, Female hammering the entire area of the entrance after filling her burrow flush.



sand left about the entrance into the hole." Olberg (1959) noted that the sand scraped back from time to time with the forelegs is hammered into place with the tip of the abdomen. The female *michiganensis* we observed came out only six times to get loose soil, spending most of the 6 minutes which it took her until final closure, hammering the earth into the burrow. After filling the burrow flush, she spent about 1 minute moving from side to side over the now completely filled nest hammering the soil. During this behavior her abdomen was bent under, nearly forming a letter C (Fig. 4). As well as vibrating up and down while hammering, her abdomen swayed laterally from side to side like a pendulum. At this time we captured the wasp. She had taken 35-40 minutes to dig, store, and fill her nest. The female *occidentalis* which Powell (1957) studied took 26 minutes for similar behavior.

The completed nest of *michiganensis* was toward one side of a small open patch of sandy-loam soil containing many pebbles (Fig. 5). The burrow entered the soil at an angle close to 30° with the horizontal and was dug into an inclined slope of about 5° . The 3-4-mm-wide tunnel was 2.5 cm long, ending in an oval cell 1.2 cm beneath the soil surface. The spider, a female *Xysticus transversatus* (Walckenaer) in the penultimate instar (Det. Wilton Ivie, Ethological No. P-102), was placed in the cell, dorsum up, with its abdomen toward the back of the cell, 5 mm wide, 5 mm high, 8-9 mm long. Evans and Yoshimoto (1962) noted a female of *michiganensis* in the University of Idaho collection pinned with a subadult female *Xysticus conctator* Thorell. The white, curved egg of *michiganensis*, nearly 2 mm long, was placed on the ventral side of the prey's abdomen, laterally and on the right, close to the basal abdominal constriction (Fig. 6). Adlerz (1903) found that the spider of *wesmaeli* lay right side up in the cell with the egg glued on its left side near the base of the abdomen.

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FIGS. 5-6. *Pompilus michiganensis* (Dreisbach). 5, Portion of field at Groton, New York, where female nested. 6, Burrow and terminal cell of wasp's nest with distal end of cell exposed showing wasp's egg attached to the spider's abdomen.

Upon excavating the nest of *occidentalis*, Powell (1957) found a 2-cm-long burrow slanting into the soil at about a 45° angle. An oval cell, 8 mm long, containing the spider ventral side down, head in, was found at the end of the tunnel. "A smooth, white, elongate egg of 2 mm. in length had been placed diagonally in a lower, lateral position near the middle of the prey's abdomen."

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